

# **EXHIBIT A**

IN THE UNITED STATES DISTRICT COURT  
FOR THE NORTHERN DISTRICT OF OHIO  
EASTERN DIVISION

IN RE NATIONAL	:	MDL No. 2804
PRESCRIPTION OPIATE	:	CASE NO. 17-MD-2804
LITIGATION	:	(DAP)
	:	

EXPERT REPORT OF CRAIG J. MCCANN, PH.D., CFA  
March 25, 2019

can also refer to the amount by which a quantity of one in the transaction falls short of or exceeds the standard size package of the NDC.<sup>19</sup>

*16. Transaction Date*

47. Transaction Date is the date a shipment occurred, not the date an order was placed by the Buyer or received by the Seller or the date of some other activity.<sup>20</sup>

*17. Calculated Base Weight in Grams*

48. The Calculated Base Weight in Grams is the total active ingredient weight, in grams, of a drug in the reported transaction. The Calculated Base Weight in Grams in the ARCOS Data produced by the DEA was not reported by the Sellers. Rather, it was calculated by the DEA and appended (along with information about the Buyer and the Seller, the Drug Code, the Drug Name, and the Dosage Units) by the DEA before the data was produced. As explained in Appendix 2, I verify the Calculated Base Weight in Grams for each transaction using the NDC Dictionary.

*18. Dosage Units*

49. Dosage Units is the number of packages in the transaction, multiplied by the number of discrete individual drug products (e.g., pills, patches, lozenges) in each package. Dosage Unit is only populated if the drug product is delivered as a capsule, tablet, film, suppository, patch, lollipop, or lozenge. The Dosage Unit in the ARCOS Data was not reported by the Sellers. Rather, it was calculated by the DEA and appended by the DEA before the

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<sup>19</sup> ARCOS Handbook, §5.17, p. 5-43.

<sup>20</sup> ARCOS Handbook, §5.15.1, p. 5-40.

weights within 1.0% of the weights I aggregate up from the processed ARCOS transaction data.

71. The RDSRs confirm the accuracy of the ARCOS Data I received. The correlation between the RDSRs' reported drug weight and the weights I calculate from the ARCOS Data is **0.999** on a scale from -1.00 to +1.00.

Table 12 Ratios of Retail Drug Summary Report and ARCOS Drug Weights

Drug Code	N	N(%)	1st Percentile	5th Percentile	25th Percentile	50th Percentile	75th Percentile	95th Percentile	99th Percentile
9050	32,155	7.9%	0.97	1.01	1.04	1.07	1.11	1.20	1.32
9064	31,923	7.8%	0.76	0.92	1.00	1.00	1.00	1.02	1.09
9120	23,214	5.7%	0.00	0.71	1.00	1.00	1.00	1.01	1.19
9143	32,119	7.9%	0.90	0.97	1.00	1.00	1.00	1.02	1.11
9150	32,042	7.8%	0.82	0.97	1.00	1.00	1.00	1.03	1.28
9193	32,164	7.9%	0.89	0.98	1.00	1.00	1.00	1.04	1.35
9220L	13,821	3.4%	0.93	0.93	0.99	1.00	1.00	1.03	1.03
9230	32,049	7.8%	0.89	0.98	1.00	1.00	1.01	1.12	1.37
9250B	32,075	7.9%	0.86	0.99	1.00	1.00	1.00	1.02	1.30
9300	32,111	7.9%	0.88	0.98	1.00	1.00	1.00	1.03	1.17
9639	30,138	7.4%	0.91	1.00	1.00	1.00	1.00	1.00	1.06
9652	31,287	7.7%	0.75	0.94	1.00	1.00	1.00	1.00	1.10
9780	21,175	5.2%	0.93	1.00	1.00	1.00	1.00	1.00	1.07
9801	32,116	7.9%	0.84	0.95	0.98	1.00	1.00	1.06	1.31
<b>Total</b>	<b>408,389</b>	<b>100.0%</b>	<b>0.81</b>	<b>0.96</b>	<b>1.00</b>	<b>1.00</b>	<b>1.00</b>	<b>1.09</b>	<b>1.24</b>

## B. Defendants' Transaction Data

72. In addition to receiving the ARCOS Data produced by the DEA, I received transaction data produced in discovery by 13 Defendants.<sup>29</sup> I

<sup>29</sup> The 13 Defendants are Anda, AmerisourceBergen, Cardinal Health, CVS, Discount Drug Mart, HBC, Henry Schein, H. D. Smith, McKesson, Prescription Supply, Rite Aid, Walgreens, and Walmart. I do not discuss the data produced by Rite Aid or Henry Schein because the produced data was insufficient to compare with the ARCOS Data. Rite Aid did not produce the Buyer's DEA numbers, and the data produced by Rite Aid does not identify which counties are included in the data. Henry Schein did not include the Buyer's DEA numbers or NDCs. Appendix 7 lists the data fields provided by each Defendant. I have standardized the names of the fields to simplify the presentation.

analyzed the Defendants' internal data and found that there are gaps in the data produced by some Defendants; with the exception of AmerisourceBergen these gaps are relatively minor.<sup>30</sup> I compared each transaction in each Defendant's internal data to the ARCOS Data. I matched the transactions based on NDC, Buyer's DEA Number, Quantity, and the calendar month. After matching the transactions, I converted the transaction Quantity to MME.

73. Table 13 presents summary statistics comparing the ARCOS Data and the Defendants' transaction data, sorted by the degree of overlap between the ARCOS Data and the Defendants' transaction data. The transactions summarized in Table 13 consist of all transactions by the Defendants with retail Buyers in Cuyahoga and Summit Counties from January 1, 2006 through December 31, 2014, involving the 14 opioids in Table 1.<sup>31</sup>

74. At first glance it appears that there is significant non-overlap between the data the Defendants produced to ARCOS in real time, which the DEA then produced, and the data the Defendants produced in discovery but after making some minor adjustments the non-overlap is quite small.

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<sup>30</sup> For example, Rite Aid only produced transactions for 2007, and only for hydrocodone (9193). Henry Schein produced only 67 transactions for 2006 through 2014.

<sup>31</sup> I keep only transactions involving NDCs on Schedule II and III.

Table 13 Overlap between ARCOS Data and Defendant Data

Defendant	Transactions in Both Datasets			Transactions Only in ARCOS			Transactions Only in Defendants		
	N	MME	MME (%)	N	MME	MME (%)	N	MME	MME (%)
Cardinal Health	544,054	3,710,172,198	99.2%	1,397	2,347,131	0.1%	11,388	27,957,628	0.7%
AmerisourceBergen	420,974	2,759,799,395	84.4%	60,750	467,226,119	14.3%	19,451	42,932,581	1.3%
McKesson	423,952	2,360,097,033	89.7%	39,318	140,948,298	5.4%	31,182	128,686,406	4.9%
Walgreens	319,997	1,406,211,786	83.9%	36,337	257,764,538	15.4%	1,963	11,825,732	0.7%
CVS	113,342	223,193,105	38.7%	34,083	334,248,179	57.9%	11,317	19,815,640	3.4%
Anda	6,217	81,340,894	66.1%	1,475	41,640,416	33.8%	25	68,932	0.1%
HD Smith	10,606	80,568,759	95.4%	527	2,181,492	2.6%	375	1,672,837	2.0%
Walmart	41,890	79,487,906	59.2%	20,729	50,122,079	37.3%	1,324	4,684,806	3.5%
HBC	68,181	67,162,504	83.6%	6,940	10,749,410	13.4%	2,462	2,421,062	3.0%
Discount Drug Mart	31,602	58,974,937	93.8%	25	54,269	0.1%	1,941	3,862,765	6.1%
Prescription Supply	8,596	39,700,220	58.6%	5,122	28,066,884	41.4%	32	2,853	0.0%
<b>Total</b>	<b>1,989,411</b>	<b>10,866,708,738</b>	<b>87.3%</b>	<b>206,703</b>	<b>1,335,348,814</b>	<b>10.7%</b>	<b>81,460</b>	<b>243,931,242</b>	<b>2.0%</b>

75. Using my initial matching criteria, 87.3% of all MME in either the ARCOS Data or the datasets produced by Defendants are in both the ARCOS Data and the datasets produced by Defendants (i.e., the MME are in the intersection of the ARCOS Data and the datasets produced by Defendants).

76. The amount of MME found in both the ARCOS Data and the datasets produced by Defendants increases if I relax the stringent matching rules I imposed. As discussed more fully below, allowing matches to cross to an adjacent month increases the MME found in both the ARCOS Data and the datasets produced by Defendants by 98.0 million MME. Correcting Buyer information (e.g., DEA numbers and county) increases the MME in both the ARCOS Data and the datasets produced by Defendants by an additional 24.1 million MME.

77. The remainder of this section of the report includes a more detailed explanation of the MME that is either (1) in the ARCOS data but not in the datasets produced by Defendants, or (2) in the datasets produced by Defendants but not in the ARCOS Data for each Defendant listed in Table 13.

## **IX. Transaction Analysis**

130. I implemented various approaches to identify transactions meeting specified criteria using the non-public ARCOS Data from 2006 to 2014, supplemented with Defendant transaction data where the ARCOS Data is obviously missing transactions that are included in the transactions produced by Defendants in discovery and to the extent I have Defendant transaction data for the periods before 2006 and after 2014. I calculated the results separately for each of twelve controlled substance drug codes.<sup>54</sup>

### **A. Maximum Monthly, Trailing Six-month Threshold**

131. Under the first approach, I identify transactions that cause the number of dosage units shipped by a Distributor to a Pharmacy in a calendar month to exceed the highest number of dosage units shipped by the Distributor to the Pharmacy in any one of the six preceding calendar months. For example, if the number of dosage units containing hydrocodone shipped from a Distributor to a Pharmacy in February, March, April, May, June, and July were 5,000; 10,000; 7,000; 8,000; 9,000; and 9,500 respectively, a requested transaction in August would be flagged if it would cause the number of dosage units containing hydrocodone the Distributor shipped to the Pharmacy to exceed 10,000. Any reported transactions containing hydrocodone on that date and all reported transactions containing hydrocodone from that Distributor to that Pharmacy thereafter are flagged.

132. In this approach and the others implemented below I have been asked by Counsel to assume that the Distributor did not effectively investigate

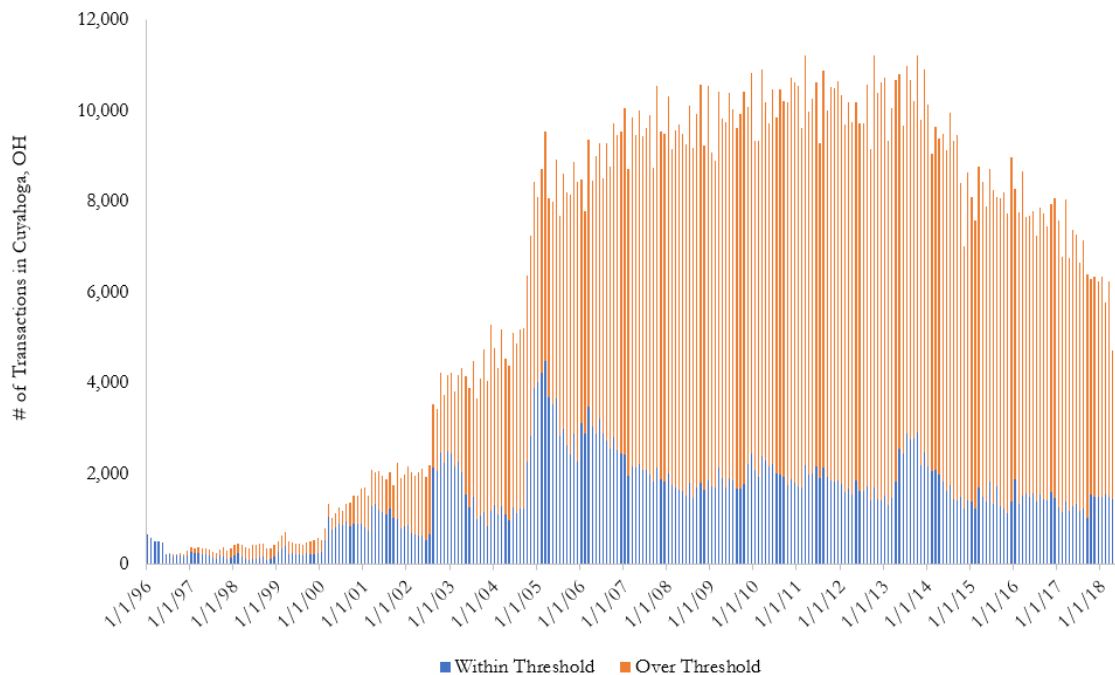
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<sup>54</sup> I do not analyze transactions in two treatment drugs: buprenorphine and methadone.

the flagged transactions and so every subsequent transaction of that drug code is also flagged because the Distributor had an unfulfilled obligation to detect and investigate the first flagged transaction.

133. Figure 11 illustrates total opioid transactions from Distributors to retail and chain pharmacies into Cuyahoga County from 1996 to 2018. The Trailing Six-Month Maximum Threshold methodology flags 76.0% of transactions accounting for 89.6% of dosage units, 73.5% of MME and 83.2% of drug weight shipped into Cuyahoga County. Additional charts and tables reflecting the result of applying this methodology and the methodologies below to each Distributor are in Appendix 10.

Figure 11 Trailing Six-Month Maximum Threshold Flagged Transactions, Cuyahoga County, OH 1996-2018

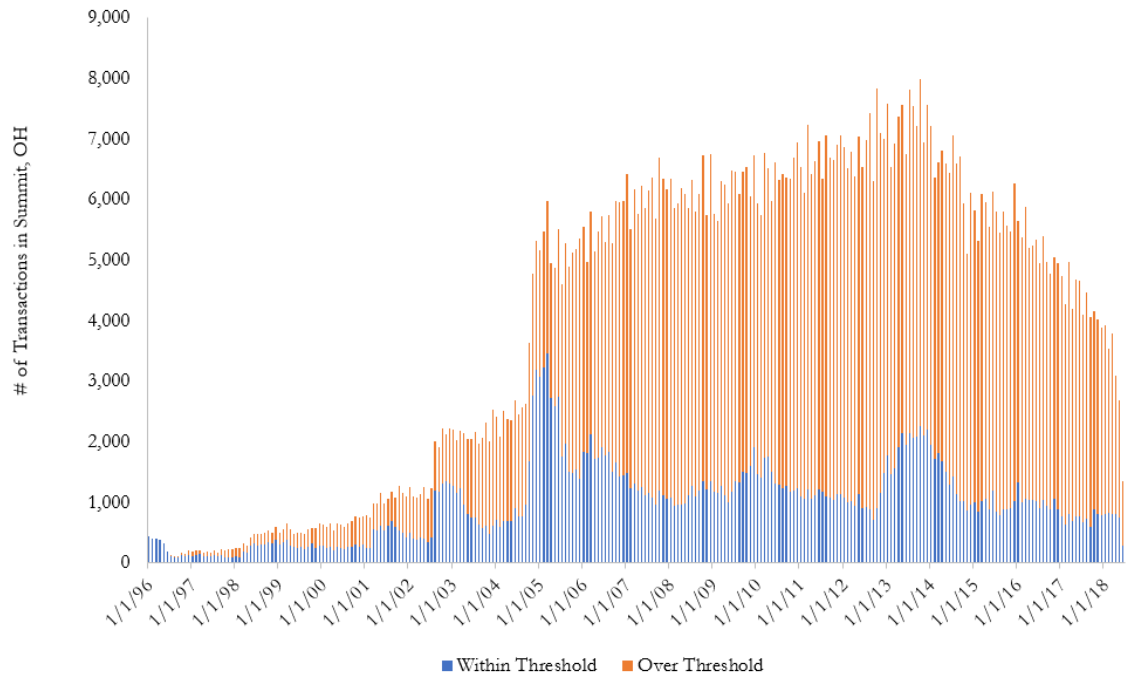


134. Figure 12 illustrates total transactions from Distributors to retail and chain pharmacies into Summit County from 1996 to 2018. The Trailing Six-Month Maximum Threshold methodology flags 75.4% of transactions



accounting for 88.5% of dosage units, 71.4% of MME and 83.1% of drug weight shipped into Summit County.

Figure 12 Trailing Six-Month Maximum Threshold Flagged Transactions, Summit County, OH, 1996-2018



135. Table 24 and Table 25 summarize the transactions in transactions flagged based on the Trailing Six-Month Maximum Threshold Approach in Cuyahoga and Summit Counties.

Table 24 Trailing Six-Month Maximum Threshold Flagged Transactions,  
Cuyahoga County, OH 1996-2018

# of Flagged Transactions	Oxycodone	Hydrocodone	Morphine	Hydromorphone	Oxymorphone	Other	Total
AmerisourceBergen	99,137	49,339	14,957	2,874	545	11,597	178,449
Anda, Inc	700	1,723	0	2	0	69	2,494
Cardinal Health	192,799	94,450	26,389	3,061	3,974	30,020	350,693
CVS	n/a	109,055	n/a	n/a	n/a	8,772	117,827
Discount Drug Mart	n/a	32,583	0	n/a	n/a	3,229	35,812
H. D. Smith	269	0	0	0	0	0	269
HBC Service Co	4,909	41,114	0	0	0	1,275	47,298
Henry Schein Inc	n/a	n/a	n/a	n/a	n/a	n/a	n/a
McKesson Corp	129,021	89,263	9,185	759	538	6,265	235,031
Miami-Luken	0	0	0	0	n/a	0	0
Prescription Supply	5,008	489	1,220	134	0	40	6,891
Rite Aid	n/a	18,828	n/a	n/a	n/a	2,748	21,576
Walgreens	97,401	100,421	19,462	3,900	0	10,744	231,928
Wal-Mart	16,070	25,737	477	76	0	990	43,350
<b>Total</b>	<b>545,314</b>	<b>563,002</b>	<b>71,690</b>	<b>10,806</b>	<b>5,057</b>	<b>75,749</b>	<b>1,271,618</b>

Table 25 Trailing Six-Month Maximum Threshold Flagged Transactions, Summit County, OH 1996-2018

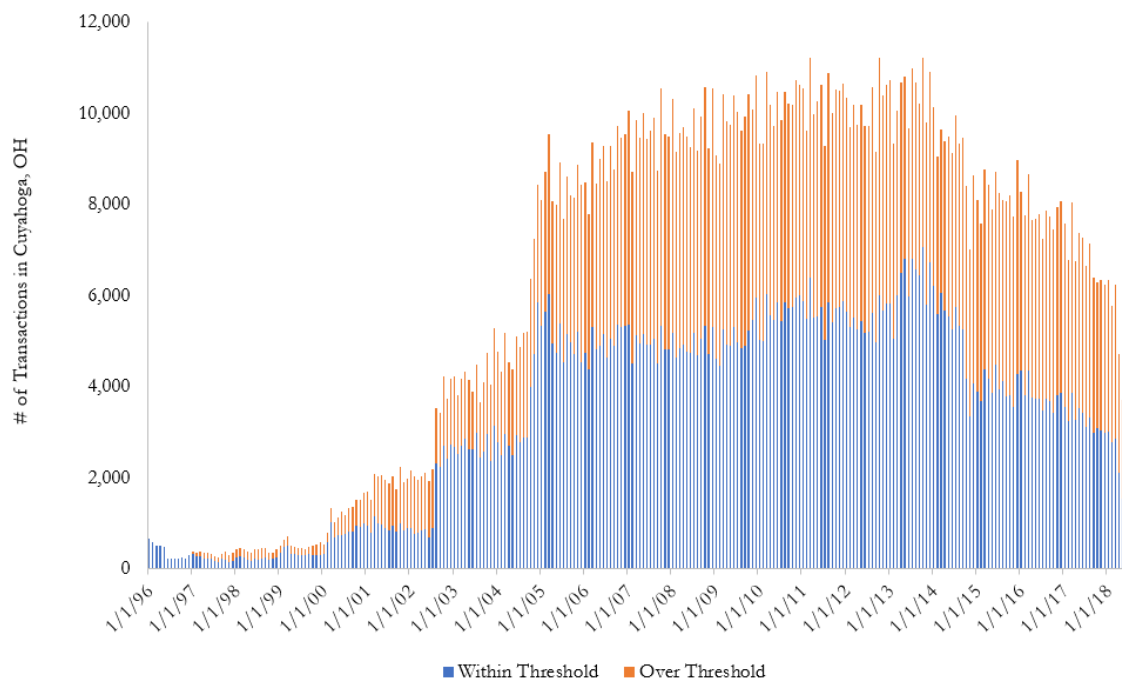
# of Flagged Transactions	Oxycodone	Hydrocodone	Morphine	Hydromorphone	Oxymorphone	Other	Total
AmerisourceBergen	77,175	52,681	21,289	6,341	2,830	10,804	171,120
Anda, Inc	690	1,302	121	2	0	188	2,303
Cardinal Health	111,200	50,300	24,731	5,707	2,638	13,065	207,641
CVS	n/a	45,927	n/a	n/a	n/a	2,624	48,551
Discount Drug Mart	n/a	8,500	0	n/a	n/a	720	9,220
H. D. Smith	60	125	0	n/a	0	0	185
HBC Service Co	2,682	26,651	0	0	0	703	30,036
Henry Schein Inc	n/a	n/a	n/a	n/a	n/a	n/a	n/a
McKesson Corp	96,172	64,409	20,338	5,156	4,116	6,280	196,471
Miami-Luken	2,999	1,308	391	0	236	0	4,934
Prescription Supply	16	4	0	0	0	0	20
Rite Aid	n/a	10,953	n/a	n/a	n/a	898	11,851
Walgreens	39,284	47,489	11,596	3,050	0	2,669	104,088
Wal-Mart	9,010	15,052	777	173	0	393	25,405
<b>Total</b>	<b>339,288</b>	<b>324,701</b>	<b>79,243</b>	<b>20,429</b>	<b>9,820</b>	<b>38,344</b>	<b>811,825</b>

### B. Twice Trailing Twelve-Month Average Pharmacy Dosage Units

136. I identify transactions that cause the number of dosage units shipped by a Distributor to a Pharmacy in a calendar month to exceed twice the trailing twelve-month average dosage units to retail and chain pharmacies served by the Distributor. I have been asked by Counsel to assume that the Distributor did not effectively investigate the flagged transactions and so every subsequent transaction of that drug code is also flagged because the Distributor had an unfulfilled obligation to detect and investigate the first flagged transaction.

137. Figure 13 illustrates total opioid shipments into Cuyahoga County from 1996 to 2018 from ARCOS Data for 2006 to 2014 and, to the extent I have Defendant transaction data for the periods before 2006 and after 2014. The Twice Trailing Twelve-Month Average Pharmacy Dosage Units Threshold methodology flags 45.6% of transactions accounting for 54.9% of dosage units, 57.1% of MME and 59.0% of drug weight shipped into Cuyahoga County.

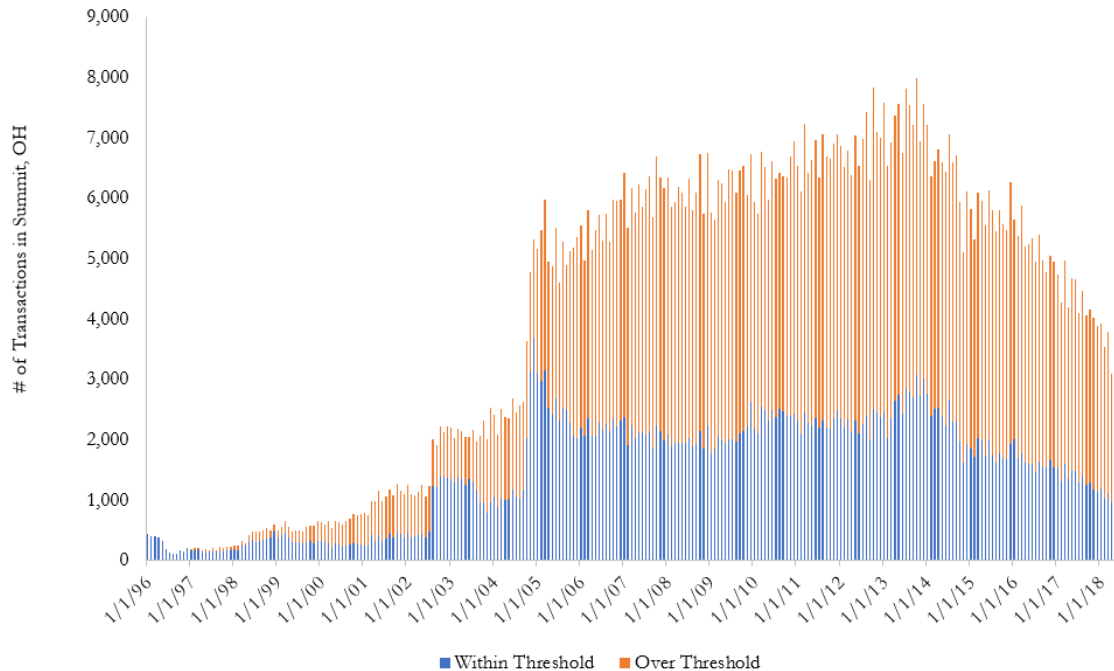
Figure 13 Twice Trailing Twelve-Month Average Pharmacy Dosage Units, Flagged Transactions, Cuyahoga County, OH 1996-2018



138. Figure 14 illustrates total shipments into Summit County from 1996 to 2018 from ARCOS Data for 2006 to 2014 and, to the extent I have Defendant transaction data for the periods before 2006 and after 2014. The Twice Trailing Twelve-Month Average Pharmacy Dosage Units Threshold

methodology flags 62.9% of transactions accounting for 72.5% of dosage units, 74.4% of MME and 72.3% of drug weight shipped to Summit County.

Figure 14 Twice Trailing Twelve-Month Average Pharmacy Dosage Units, Flagged Transactions, Summit County, OH 1996-2018



139. Table 26 and Table 27 summarize the transactions in transactions flagged based on the Twice Trailing Twelve-Month Average Pharmacy Dosage Units Threshold in Cuyahoga and Summit Counties.

Table 26 Twice Trailing Twelve-Month Average Pharmacy Dosage Units  
Threshold Flagged Transactions, Cuyahoga County, 1996-2018

# of Flagged Transactions	Oxycodone	Hydrocodone	Morphine	Hydromorphone	Oxymorphone	Other	Total
AmerisourceBergen	45,288	26,985	8,256	2,502	844	16,731	100,606
Anda, Inc	587	950	51	6	0	256	1,850
Cardinal Health	121,206	82,155	24,003	4,621	5,713	56,834	294,532
CVS	n/a	34,001	n/a	n/a	n/a	6,422	40,423
Discount Drug Mart	n/a	32,848	0	n/a	n/a	2,554	35,402
H. D. Smith	311	0	12	4	11	17	355
HBC Service Co	4,942	4,690	29	104	0	669	10,434
Henry Schein Inc	n/a	n/a	n/a	n/a	n/a	n/a	n/a
McKesson Corp	51,631	68,503	8,532	1,505	1,344	22,790	154,305
Miami-Luken	0	0	0	0	n/a	0	0
Prescription Supply	802	471	1,176	174	20	690	3,333
Rite Aid	n/a	4,145	n/a	n/a	n/a	1,452	5,597
Walgreens	42,801	18,937	15,801	5,665	30	22,409	105,643
Wal-Mart	8,469	806	494	117	0	1,357	11,243
<b>Total</b>	<b>276,037</b>	<b>274,491</b>	<b>58,354</b>	<b>14,698</b>	<b>7,962</b>	<b>132,181</b>	<b>763,723</b>

Table 27 Twice Trailing Twelve-Month Average Pharmacy Dosage Units Threshold Flagged Transactions, Summit County, OH 1996-2018

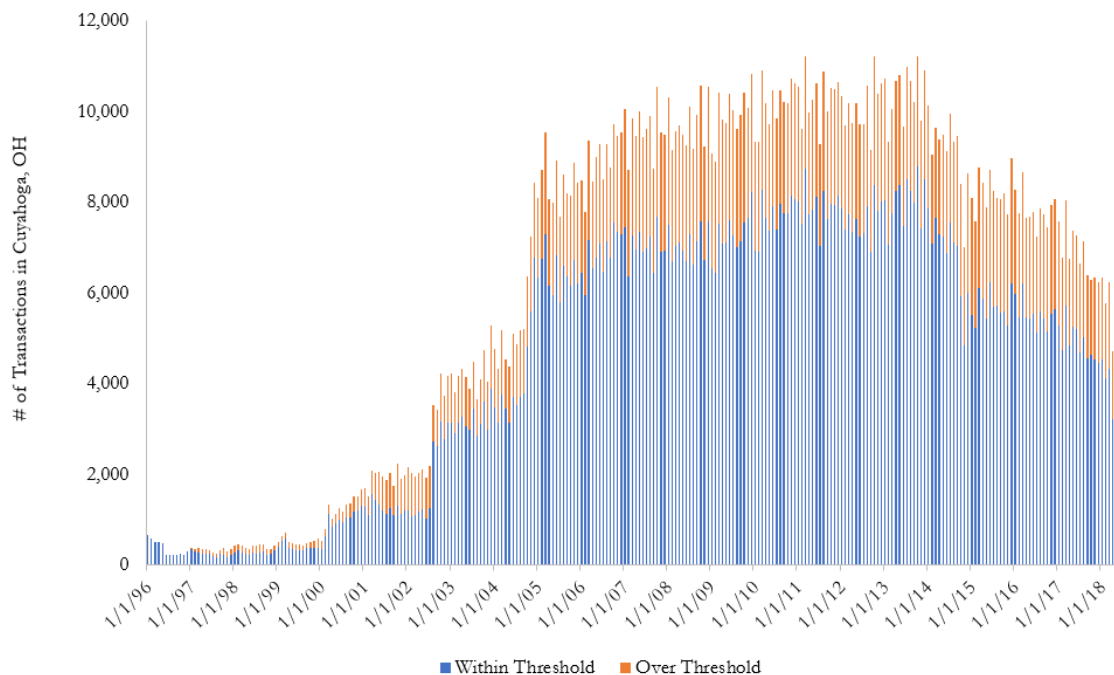
# of Flagged Transactions	Oxycodone	Hydrocodone	Morphine	Hydromorphone	Oxymorphone	Other	Total
AmerisourceBergen	41,408	48,241	17,443	6,140	3,737	22,741	139,710
Anda, Inc	1,081	1,245	221	22	0	325	2,894
Cardinal Health	84,118	48,828	27,703	7,966	4,458	35,525	208,598
CVS	n/a	27,081	n/a	n/a	n/a	1,443	28,524
Discount Drug Mart	n/a	7,405	0	n/a	n/a	533	7,938
H. D. Smith	0	105	0	n/a	0	23	128
HBC Service Co	2,025	16,692	200	28	22	491	19,458
Henry Schein Inc	n/a	n/a	n/a	n/a	n/a	n/a	n/a
McKesson Corp	64,582	62,291	20,257	6,303	5,538	24,320	183,291
Miami-Luken	2,939	1,222	452	88	304	388	5,393
Prescription Supply	0	4	0	1	0	0	5
Rite Aid	n/a	8,235	n/a	n/a	n/a	376	8,611
Walgreens	15,942	28,076	10,431	3,488	44	9,018	66,999
Wal-Mart	2,657	695	729	199	27	622	4,929
<b>Total</b>	<b>214,752</b>	<b>250,120</b>	<b>77,436</b>	<b>24,235</b>	<b>14,130</b>	<b>95,805</b>	<b>676,478</b>

### C. Three Times Trailing Twelve-Month Average Pharmacy Dosage Units

140. I identify transactions that cause the number of dosage units shipped by a Distributor to a Pharmacy in a calendar month to exceed three times the trailing twelve-month average dosage units to retail and chain pharmacies served by the Distributor. I have been asked by Counsel to assume that the Distributor did not effectively investigate the flagged transactions and so every subsequent transaction of that drug code is also flagged because the Distributor had an unfulfilled obligation to detect and investigate the first flagged transaction.

141. Figure 15 illustrates total opioid shipments into Cuyahoga County from 1996 to 2018 from ARCOS Data for 2006 to 2014 and, to the extent I have Defendant transaction data for the periods before 2006 and after 2014. The Three Times Trailing Twelve-Month Average Pharmacy Dosage Units Threshold methodology flags 26.0% of transactions accounting for 32.3% of dosage units, 33.5% of MME and 34.8% of drug weight shipped into Cuyahoga County.

Figure 15 Three Times Trailing Twelve-Month Average Pharmacy Dosage Units Flagged Transactions, Cuyahoga County, OH 1996-2018

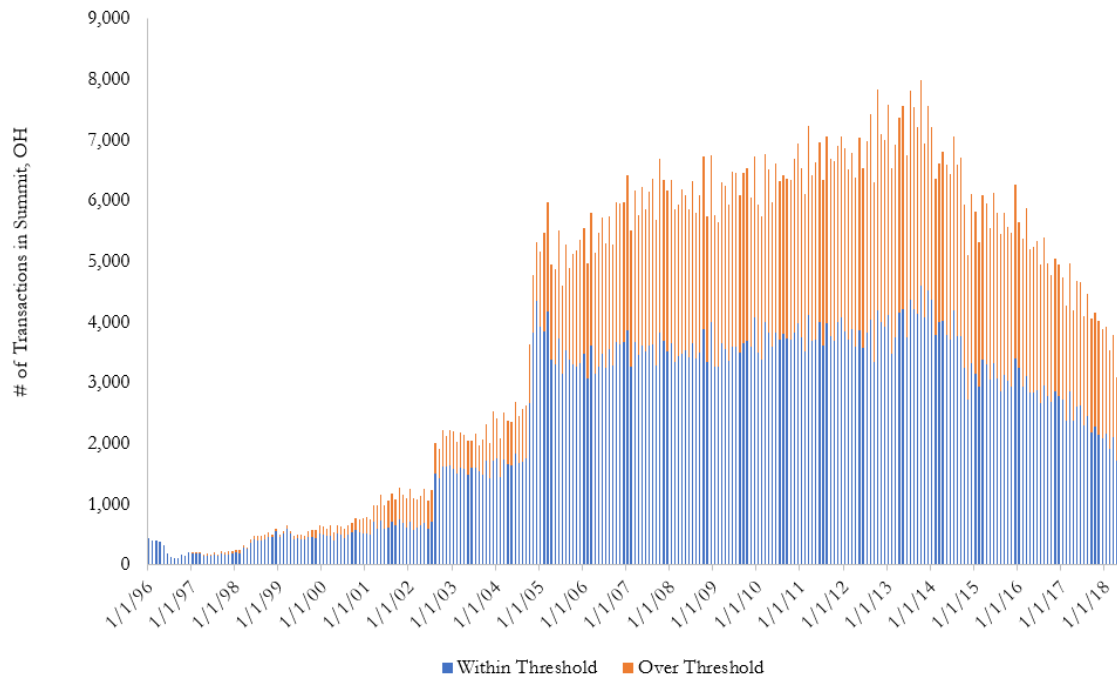


142. Figure 16 illustrates total shipments into Summit County from 1996 to 2018 from ARCOS Data for 2006 to 2014 and, to the extent I have Defendant transaction data for the periods before 2006 and after 2014. The Three Times Trailing Twelve-Month Average Pharmacy Dosage Units Threshold methodology flags 40.5% of transactions accounting for 50.0% of



dosage units, 53.3% of MME and 51.4% of drug weight shipped into Summit County.

Figure 16 Three Times Trailing Twelve-Month Average Pharmacy Dosage Units Flagged Transactions, Summit County, OH 1996-2018



143. Table 28 and Table 29 summarize the transactions in transactions flagged based on the Three Times Trailing Twelve-Month Average Pharmacy Dosage Units Threshold in Cuyahoga and Summit Counties.

Table 28 Three Times Trailing Twelve-Month Average Pharmacy Dosage Units Threshold Flagged Transactions, Cuyahoga County, OH 1996-2018

<b># of Flagged Transactions</b>	<b>Oxycodone</b>	<b>Hydrocodone</b>	<b>Morphine</b>	<b>Hydromorphone</b>	<b>Oxymorphone</b>	<b>Other</b>	<b>Total</b>
AmerisourceBergen	22,663	14,792	3,933	1,319	289	10,561	53,557
Anda, Inc	306	584	3	0	0	182	1,075
Cardinal Health	62,297	67,273	17,572	2,867	4,475	39,223	193,707
CVS	n/a	13,485	n/a	n/a	n/a	2,619	16,104
Discount Drug Mart	n/a	32,445	0	n/a	n/a	1,995	34,440
H. D. Smith	311	0	0	0	0	0	311
HBC Service Co	1,652	2,069	12	34	0	42	3,809
Henry Schein Inc	n/a	n/a	n/a	n/a	n/a	n/a	n/a
McKesson Corp	31,620	41,655	4,172	730	581	13,998	92,756
Miami-Luken	0	0	0	0	n/a	0	0
Prescription Supply	96	468	838	148	1	428	1,979
Rite Aid	n/a	2,631	n/a	n/a	n/a	719	3,350
Walgreens	909	4,490	9,292	3,753	9	11,522	29,975
Wal-Mart	3,239	0	177	69	0	150	3,635
<b>Total</b>	<b>123,093</b>	<b>179,892</b>	<b>35,999</b>	<b>8,920</b>	<b>5,355</b>	<b>81,439</b>	<b>434,698</b>

Table 29 Three Times Trailing Twelve-Month Average Pharmacy Dosage Units Threshold Flagged Transactions, Summit County, OH 1996-2018

# of Flagged Transactions	Oxycodone	Hydrocodone	Morphine	Hydromorphone	Oxymorphone	Other	Total
AmerisourceBergen	26,024	40,096	10,643	4,823	3,051	13,724	98,361
Anda, Inc	981	993	177	21	0	295	2,467
Cardinal Health	49,733	42,267	21,073	6,408	2,295	24,609	146,385
CVS	n/a	17,930	n/a	n/a	n/a	370	18,300
Discount Drug Mart	n/a	7,278	0	n/a	n/a	403	7,681
H. D. Smith	0	91	0	n/a	0	23	114
HBC Service Co	857	8,099	103	0	13	114	9,186
Henry Schein Inc	n/a	n/a	n/a	n/a	n/a	n/a	n/a
McKesson Corp	36,410	48,607	16,642	4,721	4,198	16,232	126,810
Miami-Luken	0	1,111	0	79	243	331	1,764
Prescription Supply	0	4	0	0	0	0	4
Rite Aid	n/a	2,062	n/a	n/a	n/a	129	2,191
Walgreens	0	6,712	6,788	2,491	44	4,516	20,551
Wal-Mart	1,403	0	713	173	0	131	2,420
<b>Total</b>	<b>115,408</b>	<b>175,250</b>	<b>56,139</b>	<b>18,716</b>	<b>9,844</b>	<b>60,877</b>	<b>436,234</b>

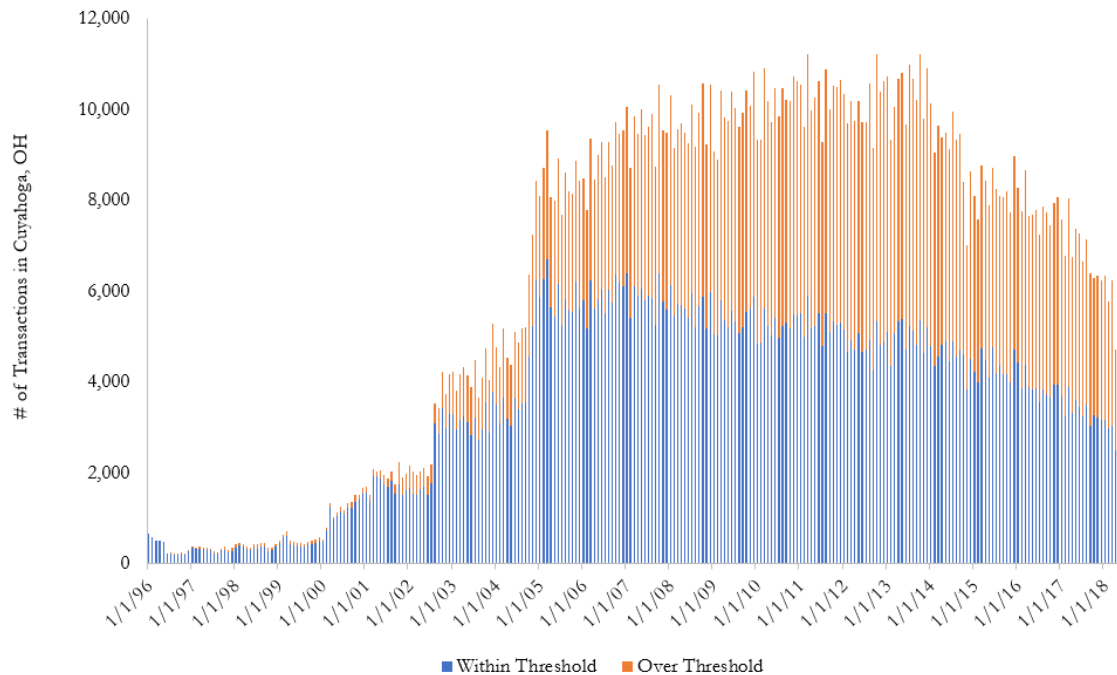
#### D. Maximum 8,000 Dosage Units Monthly

144. I identify transactions that cause the number of dosage units shipped by a Distributor to a Pharmacy in a calendar month to exceed 8,000 dosage units. I have been asked by Counsel to assume that the Distributor did not effectively investigate the flagged transactions and so every subsequent transaction of that drug code is also flagged because the Distributor had an unfulfilled obligation to detect and investigate the first flagged transaction.

145. Figure 17 illustrates total opioid shipments into Cuyahoga County from 1996 to 2018 from ARCOS Data for 2006 to 2014 and, to the extent I have Defendant transaction data for the periods before 2006 and after

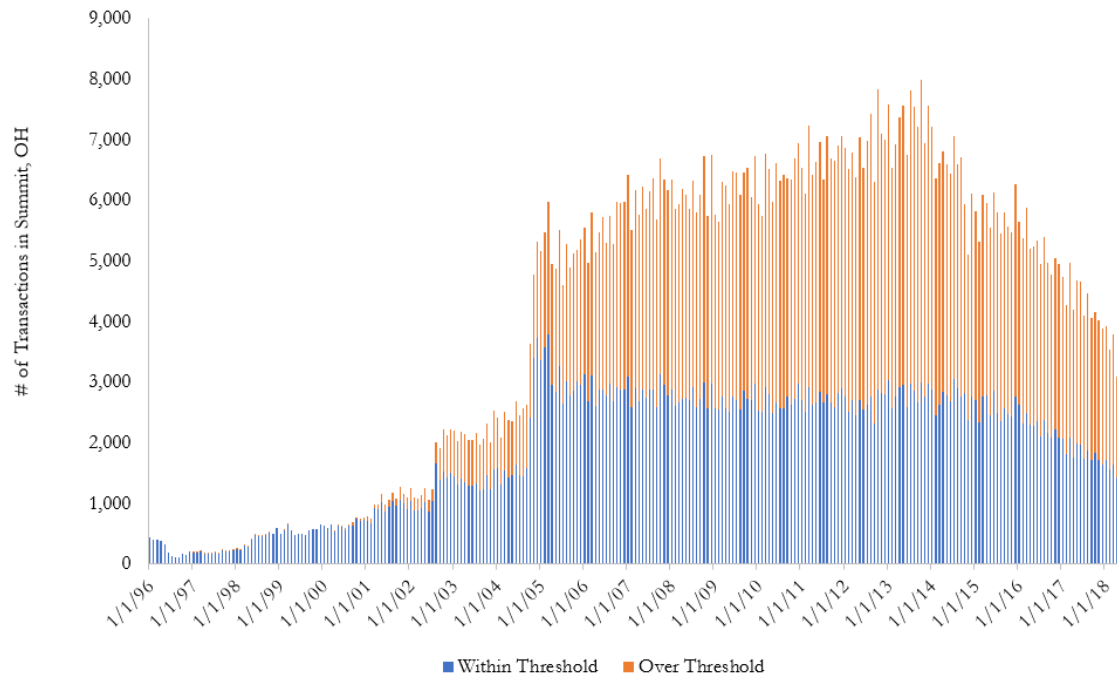
2014. The Maximum 8,000 Dosage Units Monthly Threshold methodology flags 42.6% of transactions accounting for 61.4% of dosage units, 50.2% of MME and 49.9% of drug weight shipped into Cuyahoga County.

Figure 17 Maximum 8,000 Dosage Units Monthly Flagged Transactions, Cuyahoga County, OH 1996-2018



146. Figure 18 illustrates total shipments into Summit County from 1996 to 2018 from ARCOS Data for 2006 to 2014 and, to the extent I have Defendant transaction data for the periods before 2006 and after 2014. The Maximum 8,000 Dosage Units Monthly Threshold methodology flags 52.4% of transactions accounting for 76.0% of dosage units, 54.7% of MME and 62.7% of drug weight shipped into Summit County.

Figure 18 Maximum 8,000 Dosage Units Monthly Flagged Transactions, Summit County, OH 1996-2018



147. Table 30 and Table 31 summarize the transactions in transactions flagged based on the Maximum 8,000 Dosage Units Monthly Threshold Approach in Cuyahoga and Summit Counties.

Table 30 Maximum 8,000 Dosage Units Monthly Threshold Flagged Transactions, Cuyahoga County, OH 1996-2018

# of Flagged Transactions	Oxycodone	Hydrocodone	Morphine	Hydromorphone	Oxymorphone	Other	Total
AmerisourceBergen	94,012	27,456	949	0	0	1,187	123,604
Anda, Inc	17	55	0	0	0	0	72
Cardinal Health	110,826	48,016	2,102	0	0	1,731	162,675
CVS	n/a	63,845	n/a	n/a	n/a	0	63,845
Discount Drug Mart	n/a	20,875	0	n/a	n/a	0	20,875
H. D. Smith	308	0	0	0	0	0	308
HBC Service Co	3,992	28,758	0	0	0	0	32,750
Henry Schein Inc	n/a	n/a	n/a	n/a	n/a	n/a	n/a
McKesson Corp	77,402	31,364	0	0	0	0	108,766
Miami-Luken	0	0	0	0	n/a	0	0
Prescription Supply	3,312	0	0	0	0	0	3,312
Rite Aid	n/a	9,603	n/a	n/a	n/a	0	9,603
Walgreens	88,496	74,958	0	0	0	0	163,454
Wal-Mart	9,165	15,540	0	0	0	0	24,705
<b>Total</b>	<b>387,530</b>	<b>320,470</b>	<b>3,051</b>	<b>0</b>	<b>0</b>	<b>2,918</b>	<b>713,969</b>

Table 31 Maximum 8,000 Dosage Units Monthly Threshold Flagged Transactions, Summit County, OH 1996-2018

# of Flagged Transactions	Oxycodone	Hydrocodone	Morphine	Hydromorphone	Oxymorphone	Other	Total
AmerisourceBergen	68,640	50,724	3,831	1,071	2,265	0	126,531
Anda, Inc	811	25	109	0	0	0	945
Cardinal Health	80,037	31,077	3,214	927	748	570	116,573
CVS	n/a	46,272	n/a	n/a	n/a	0	46,272
Discount Drug Mart	n/a	6,299	0	n/a	n/a	0	6,299
H. D. Smith	0	0	0	n/a	0	0	0
HBC Service Co	2,107	25,874	0	0	0	0	27,981
Henry Schein Inc	n/a	n/a	n/a	n/a	n/a	n/a	n/a
McKesson Corp	78,847	44,278	4,036	1,050	0	0	128,211
Miami-Luken	3,180	0	0	0	0	0	3,180
Prescription Supply	0	0	0	0	0	0	0
Rite Aid	n/a	12,057	n/a	n/a	n/a	0	12,057
Walgreens	36,774	48,454	0	0	0	0	85,228
Wal-Mart	2,897	7,740	0	0	0	0	10,637
<b>Total</b>	<b>273,293</b>	<b>272,800</b>	<b>11,190</b>	<b>3,048</b>	<b>3,013</b>	<b>570</b>	<b>563,914</b>

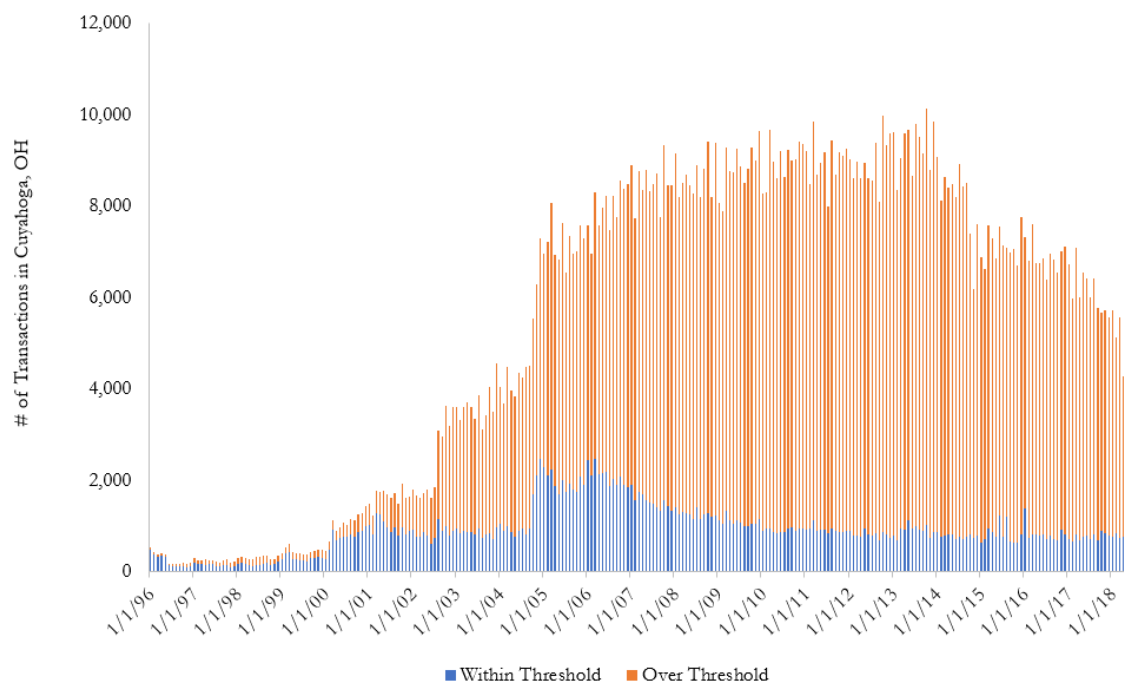
### E. Maximum Daily Dosage Units

148. I identify transactions that cause the number of dosage units shipped by a Distributor to a Pharmacy in a day to exceed a number of dosage units that varies by drug type and within some drug types by formulation.<sup>55</sup> I have been asked by Counsel to assume that the Distributor did not effectively investigate the flagged transactions and so every subsequent transaction of that drug code is also flagged because the Distributor had an unfulfilled obligation to detect and investigate the first flagged transaction.

<sup>55</sup> Maximum Daily Dosage Units used as specified in CAH\_MDLPRIORPRO\_DEA07\_01384160

149. Figure 19 illustrates total opioid shipments into Cuyahoga County from 1996 to 2018 from ARCOS Data for 2006 to 2014 and, to the extent I have Defendant transaction data for the periods before 2006 and after 2014. The Maximum Daily Dosage Units Threshold methodology flags 83.3% of transactions accounting for 92.0% of dosage units, 91.1% of MME and 84.8% of drug weight shipped into Cuyahoga County.

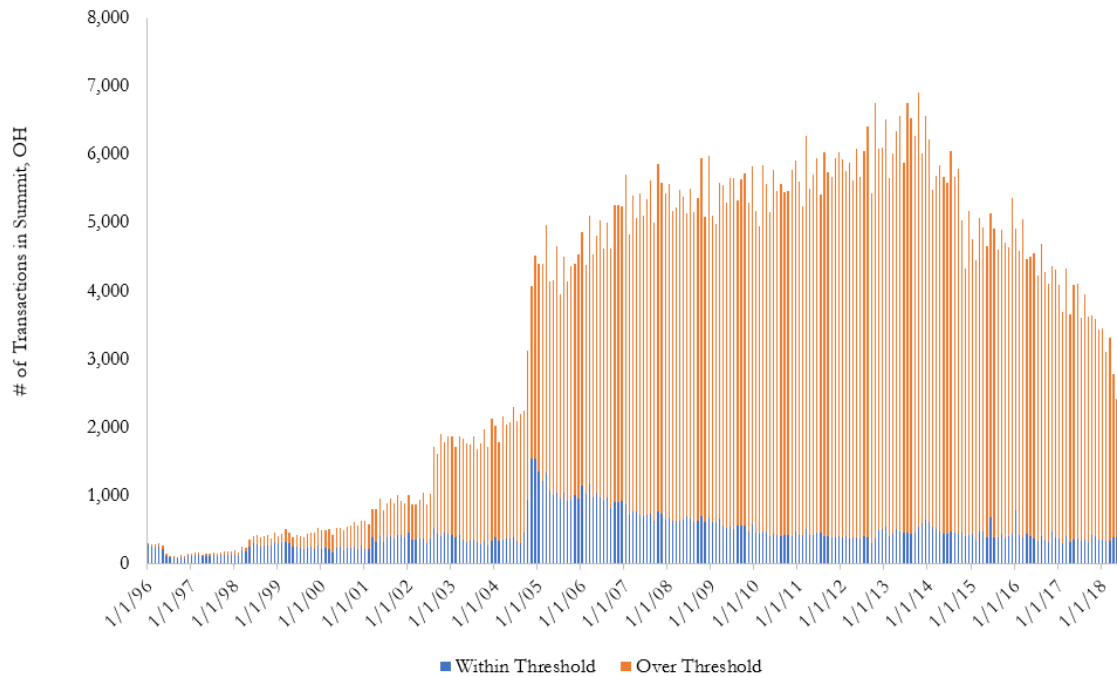
Figure 19 Maximum Daily Dosage Units, Any Order Subsequent to an Flagged Order, Cuyahoga County



150. Figure 20 illustrates total opioid transactions into Summit County. The Maximum Daily Dosage Units Threshold methodology flags 86.8% of transactions accounting for 94.4% of dosage units, 94.0% of MME and 89.6% of drug weight shipped into Summit County.



Figure 20 Maximum Daily Dosage Units, Any Order Subsequent to an Flagged Transactions, Summit County



151. Table 32 and Table 33 summarize the transactions in transactions flagged based on the Maximum Daily Dosage Units Threshold Approach in Cuyahoga and Summit Counties.

Table 32 Maximum Daily Dosage Units Threshold Flagged Transactions in Cuyahoga County, 1996-2018

# of Flagged Transactions	Oxycodone	Hydrocodone	Morphine	Hydromorphone	Oxymorphone	Other	Total
AmerisourceBergen	107,350	52,226	18,018	3,366	n/a	3,292	184,252
Anda, Inc	904	2,129	46	20	n/a	95	3,194
Cardinal Health	166,869	88,662	30,253	4,244	n/a	10,147	300,175
CVS	n/a	115,449	n/a	n/a	n/a	5,951	121,400
Discount Drug Mart	n/a	32,424	0	n/a	n/a	2,036	34,460
H. D. Smith	311	19	0	4	n/a	18	352
HBC Service Co	5,978	46,103	0	0	n/a	10	52,091
Henry Schein Inc	n/a	n/a	n/a	n/a	n/a	n/a	n/a
McKesson Corp	118,299	88,832	9,825	1,154	n/a	1,298	219,408
Miami-Luken	2	133	0	0	n/a	0	135
Prescription Supply	5,351	521	1,471	162	n/a	6	7,511
Rite Aid	n/a	21,291	n/a	n/a	n/a	1,343	22,634
Walgreens	97,777	107,036	21,923	3,733	n/a	6,949	237,418
Wal-Mart	14,593	26,963	818	76	n/a	387	42,837
<b>Total</b>	<b>517,434</b>	<b>581,788</b>	<b>82,354</b>	<b>12,759</b>	<b>n/a</b>	<b>31,532</b>	<b>1,225,867</b>

Table 33 Maximum Daily Dosage Units Threshold Flagged Transactions in Summit County, 1996-2018

# of Flagged Transactions	Oxycodone	Hydrocodone	Morphine	Hydromorphone	Oxymorphone	Other	Total
AmerisourceBergen	80,140	59,406	23,672	7,252	n/a	2,196	172,666
Anda, Inc	1,130	1,566	205	41	n/a	19	2,961
Cardinal Health	104,253	52,285	27,023	6,358	n/a	4,104	194,023
CVS	n/a	49,701	n/a	n/a	n/a	1,759	51,460
Discount Drug Mart	n/a	8,435	0	n/a	n/a	357	8,792
H. D. Smith	0	74	0	n/a	n/a	0	74
HBC Service Co	2,858	29,533	33	0	n/a	0	32,424
Henry Schein Inc	n/a	n/a	n/a	n/a	n/a	n/a	n/a
McKesson Corp	96,342	69,871	21,349	5,883	n/a	518	193,963
Miami-Luken	3,184	1,404	476	53	n/a	0	5,117
Prescription Supply	15	5	0	1	n/a	0	21
Rite Aid	n/a	12,512	n/a	n/a	n/a	177	12,689
Walgreens	40,192	50,679	12,257	3,059	n/a	353	106,540
Wal-Mart	7,411	14,905	1,013	169	n/a	96	23,594
<b>Total</b>	<b>335,525</b>	<b>350,376</b>	<b>86,028</b>	<b>22,816</b>	<b>n/a</b>	<b>9,579</b>	<b>804,324</b>

### F. Additional Identification

152. I have been asked by Counsel to assume that Chain Distributors may have had knowledge of - or information available to inform them of - opioid shipments from all Distributors to the Chain Distributor's affiliated pharmacies. I have re-run the five identification routines described above assuming that the Chain Distributors could have flagged transactions based on this expanded information set and report the results for the Chain Distributors in Table 34 through Table 43 below. Additional charts and tables reflecting the result of applying methodologies below to each Chain Distributor are in Appendix 11.

*1. Maximum Monthly, Trailing Six-month Threshold*

Table 34 Trailing Six-Month Maximum Threshold Flagged Transactions, Cuyahoga County, OH 2006-2014

<b>No. of Flagged Transactions</b>	<b>Oxycodone</b>	<b>Hydrocodone</b>	<b>Morphine</b>	<b>Hydromorphone</b>	<b>Oxymorphone</b>	<b>Other</b>	<b>Total</b>
CVS	65,249	86,461	9,769	908	1,130	12,154	175,671
Discount Drug Mart	18,313	24,531	2,416	98	0	1,786	47,144
HBC / Giant Eagle	27,810	74,444	297	20	0	5,202	107,773
Rite Aid	45,986	38,903	5,553	282	396	6,000	97,120
Walgreens	100,484	86,597	22,490	5,374	1,294	12,712	228,951
Wal-Mart	10,520	22,448	213	74	0	1,185	34,440
<b>Total</b>	<b>268,362</b>	<b>333,384</b>	<b>40,738</b>	<b>6,756</b>	<b>2,820</b>	<b>39,039</b>	<b>691,099</b>

Table 35 Trailing Six-Month Maximum Threshold Flagged Transactions, Summit County, OH 2006-2014

<b>No. of Flagged Transactions</b>	<b>Oxycodone</b>	<b>Hydrocodone</b>	<b>Morphine</b>	<b>Hydromorphone</b>	<b>Oxymorphone</b>	<b>Other</b>	<b>Total</b>
CVS	34,067	37,475	9,393	2,242	986	3,487	87,650
Discount Drug Mart	6,052	6,300	1,305	245	71	420	14,393
HBC / Giant Eagle	21,246	50,968	3,772	941	119	2,415	79,461
Rite Aid	18,263	18,990	4,587	1,106	651	1,665	45,262
Walgreens	39,482	39,538	13,088	4,099	280	3,772	100,259
Wal-Mart	5,960	13,442	522	158	0	494	20,576
<b>Total</b>	<b>125,070</b>	<b>166,713</b>	<b>32,667</b>	<b>8,791</b>	<b>2,107</b>	<b>12,253</b>	<b>347,601</b>

2. *Twice Trailing Twelve-Month Average Pharmacy Dosage Units*

Table 36 Twice Trailing Twelve-Month Average Pharmacy Dosage Units Threshold Flagged Transactions, 2006-2014

<b>No. of Flagged Transactions</b>	<b>Oxycodone</b>	<b>Hydrocodone</b>	<b>Morphine</b>	<b>Hydromorphone</b>	<b>Oxymorphone</b>	<b>Other</b>	<b>Total</b>
CVS	30,660	17,708	4,925	639	1,731	15,169	70,832
Discount Drug Mart	4,897	1,600	1,637	145	140	3,532	11,951
HBC / Giant Eagle	0	0	126	78	102	3,543	3,849
Rite Aid	31,051	8,623	3,661	680	1,162	6,999	52,176
Walgreens	65,885	5,542	8,621	4,170	2,943	18,839	106,000
Wal-Mart	4,883	0	154	57	72	1,101	6,267
<b>Total</b>	<b>137,376</b>	<b>33,473</b>	<b>19,124</b>	<b>5,769</b>	<b>6,150</b>	<b>49,183</b>	<b>251,075</b>

Table 37 Twice Trailing Twelve-Month Average Pharmacy Dosage Units Threshold Flagged Transactions, Summit County, OH 2006-2014

<b>No. of Flagged Transactions</b>	<b>Oxycodone</b>	<b>Hydrocodone</b>	<b>Morphine</b>	<b>Hydromorphone</b>	<b>Oxymorphone</b>	<b>Other</b>	<b>Total</b>
CVS	21,880	18,368	7,226	2,271	1,731	6,221	57,697
Discount Drug Mart	0	62	1,158	398	306	1,221	3,145
HBC / Giant Eagle	8,118	14,073	3,617	1,274	660	3,222	30,964
Rite Aid	16,583	11,853	4,192	1,154	969	3,227	37,978
Walgreens	29,185	6,270	10,156	3,704	1,525	4,954	55,794
Wal-Mart	1,556	0	474	164	99	484	2,777
<b>Total</b>	<b>77,322</b>	<b>50,626</b>	<b>26,823</b>	<b>8,965</b>	<b>5,290</b>	<b>19,329</b>	<b>188,355</b>

3. *Three Times Trailing Twelve-Month Average Pharmacy Dosage Units*

Table 38 Three Times Trailing Twelve-Month Average Pharmacy Dosage Units Threshold Flagged Transactions, Cuyahoga County, OH 2006-2014

No. of Flagged Transactions	Oxycodone	Hydrocodone	Morphine	Hydromorphone	Oxymorphone	Other	Total
CVS	12,948	6,453	2,522	322	1,282	8,874	32,401
Discount Drug Mart	0	0	514	98	0	2,227	2,839
HBC / Giant Eagle	0	0	0	20	0	1,537	1,557
Rite Aid	19,405	3,677	2,009	119	515	3,770	29,495
Walgreens	27,854	0	2,086	1,391	1,656	8,959	41,946
Wal-Mart	1,385	0	154	15	9	38	1,601
<b>Total</b>	<b>61,592</b>	<b>10,130</b>	<b>7,285</b>	<b>1,965</b>	<b>3,462</b>	<b>25,405</b>	<b>109,839</b>

Table 39 Three Trailing Twelve-Month Average Pharmacy Dosage Units Threshold Flagged Transactions, Summit County, OH 2006-2014

No. of Flagged Transactions	Oxycodone	Hydrocodone	Morphine	Hydromorphone	Oxymorphone	Other	Total
CVS	9,034	9,669	3,800	1,407	1,324	2,239	27,473
Discount Drug Mart	0	21	390	208	71	518	1,208
HBC / Giant Eagle	5,929	8,228	2,401	941	216	1,976	19,691
Rite Aid	9,980	2,895	3,074	925	774	1,093	18,741
Walgreens	15,672	0	2,247	1,579	668	1,942	22,108
Wal-Mart	313	0	458	158	36	381	1,346
<b>Total</b>	<b>40,928</b>	<b>20,813</b>	<b>12,370</b>	<b>5,218</b>	<b>3,089</b>	<b>8,149</b>	<b>90,567</b>

4. *Maximum 8,000 Dosage Units Monthly*

Table 40 Maximum 8,000 Dosage Units Monthly Threshold Flagged Transactions, Cuyahoga County, OH 2006-2014

<b>No. of Flagged Transactions</b>	<b>Oxycodone</b>	<b>Hydrocodone</b>	<b>Morphine</b>	<b>Hydromorphone</b>	<b>Oxymorphone</b>	<b>Other</b>	<b>Total</b>
CVS	50,282	61,480	0	0	0	0	111,762
Discount Drug Mart	13,464	20,375	0	0	0	0	33,839
HBC / Giant Eagle	6,877	50,434	0	0	0	0	57,311
Rite Aid	35,750	19,305	0	0	0	0	55,055
Walgreens	99,861	73,377	0	0	0	0	173,238
Wal-Mart	4,814	12,998	0	0	0	0	17,812
<b>Total</b>	<b>211,048</b>	<b>237,969</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>449,017</b>

Table 41 Maximum 8,000 Dosage Units Monthly Threshold Flagged Transactions, Summit County, OH 2006-2014

<b>No. of Flagged Transactions</b>	<b>Oxycodone</b>	<b>Hydrocodone</b>	<b>Morphine</b>	<b>Hydromorphone</b>	<b>Oxymorphone</b>	<b>Other</b>	<b>Total</b>
CVS	34,946	38,798	0	0	0	71	73,815
Discount Drug Mart	3,424	5,523	0	0	0	0	8,947
HBC / Giant Eagle	15,938	42,894	0	0	0	0	58,832
Rite Aid	18,618	20,304	0	0	0	0	38,922
Walgreens	42,349	42,821	0	0	0	0	85,170
Wal-Mart	1,345	6,806	0	0	0	0	8,151
<b>Total</b>	<b>116,620</b>	<b>157,146</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>71</b>	<b>273,837</b>

5. *Maximum Daily Dosage Units*

Table 42 Maximum Daily Dosage Units Threshold Flagged Transactions in Cuyahoga County, 2006-2014

<b>No. of Flagged Transactions</b>	<b>Oxycodone</b>	<b>Hydrocodone</b>	<b>Morphine</b>	<b>Hydromorphone</b>	<b>Oxymorphone</b>	<b>Other</b>	<b>Total</b>
CVS	63,914	96,391	11,355	1,753	n/a	7,237	180,650
Discount Drug Mart	18,246	26,801	3,023	202	n/a	381	48,653
HBC / Giant Eagle	21,554	74,603	382	24	n/a	1,238	97,801
Rite Aid	45,264	42,065	5,584	638	n/a	3,969	97,520
Walgreens	105,081	96,179	24,784	5,156	n/a	8,830	240,030
Wal-Mart	9,093	24,354	391	74	n/a	491	34,403
<b>Total</b>	<b>263,152</b>	<b>360,393</b>	<b>45,519</b>	<b>7,847</b>	<b>n/a</b>	<b>22,146</b>	<b>699,057</b>

Table 43 Maximum Daily Dosage Units Threshold Flagged Transactions in Summit County, 2006-2014

<b>No. of Flagged Transactions</b>	<b>Oxycodone</b>	<b>Hydrocodone</b>	<b>Morphine</b>	<b>Hydromorphone</b>	<b>Oxymorphone</b>	<b>Other</b>	<b>Total</b>
CVS	36,542	41,052	9,946	2,592	n/a	2,020	92,152
Discount Drug Mart	6,050	6,849	1,692	245	n/a	170	15,006
HBC / Giant Eagle	20,496	51,934	3,737	873	n/a	594	77,634
Rite Aid	19,365	20,835	4,762	1,388	n/a	736	47,086
Walgreens	42,932	43,575	14,064	4,225	n/a	416	105,212
Wal-Mart	4,273	14,134	662	154	n/a	105	19,328
<b>Total</b>	<b>129,658</b>	<b>178,379</b>	<b>34,863</b>	<b>9,477</b>	<b>n/a</b>	<b>4,041</b>	<b>356,418</b>



increased from 1997 to 2010 and thereafter declined so that per capita opioid MME in 2017 was 3.7 times per capita opioid MME in 1997 in Ohio.

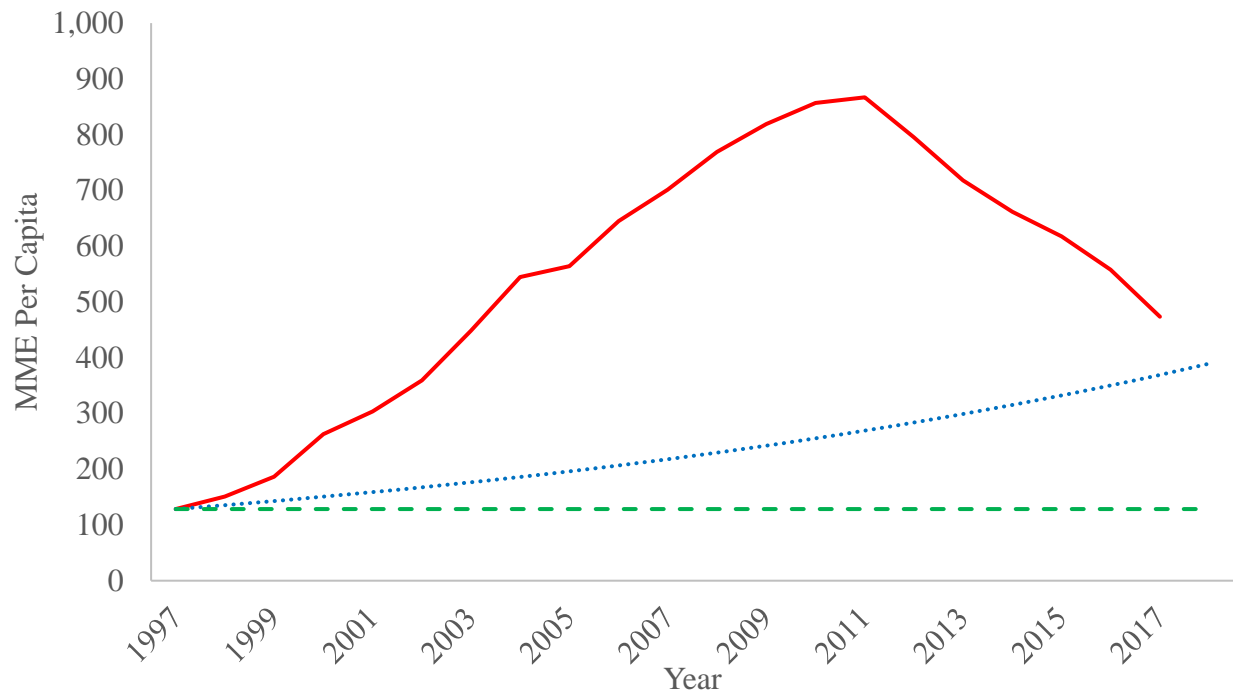
155. A possible upper bound on the medically necessary opioid MME per capita baseline is the per capita MME interpolated from 1997 to 2018. This baseline assumes that all prescriptions of opioids in 1997 and in 2018 were medically necessary and that the drivers of legitimate opioid use (eg. aging of the population) evolve gradually rather than discontinuously over time. Plaintiffs allege that opioid consumption in 2018 remained excessive and was still influenced by the Defendants' alleged fraudulent conduct.

156. A possible lower bound on the medically necessary opioid MME per capita baseline is the 1997 per capita MME. This baseline assumes that all prescriptions of opioids in 1997 were necessary and opioid use per capita beyond 1997 levels were unnecessary.

157. I plot these two baselines in Figure 24 along with the per capita MME shipped into Ohio from Figure 21.

Figure 24 Per Capita Opioid Actual and Baseline MME to Ohio, 1997-2018

— Actual MME Per Capita    ..... 1997-2018 Interpolated Baseline    - - - 1997 Constant Baseline



158. The difference between the actual shipments of opioids into Ohio and the baseline is an estimate of the excessive opioids shipped into Ohio.

- Using the 1997-2018 interpolated baseline, 76.24 billion MME or 58.6% of the 130.18 billion total MME shipped into Ohio from 1998 to 2017 was excessive.
- Using the 1997 baseline, 100.66 billion MME or 77.3% of the 130.18 billion total MME shipped into Ohio was excessive. See Table 44.

Table 44 Excessive Opioid MME in Ohio

Year	Ohio MME (billions)	1997-2018 Interpolated			1997 Per Capita		
		Baseline			Baseline		
		Baseline	Excess	Excess%	Baseline	Excess	Excess%
1997	1.45	1.45	-		1.45	-	
1998	1.70	1.53	0.17	10.1%	1.45	0.25	14.7%
1999	2.11	1.62	0.50	23.4%	1.46	0.66	31.1%
2000	2.99	1.71	1.28	42.8%	1.46	1.53	51.1%
2001	3.45	1.81	1.65	47.7%	1.46	1.99	57.7%
2002	4.10	1.91	2.19	53.4%	1.47	2.63	64.2%
2003	5.12	2.02	3.11	60.7%	1.47	3.66	71.3%
2004	6.24	2.13	4.11	65.9%	1.47	4.76	76.4%
2005	6.47	2.25	4.22	65.3%	1.47	5.00	77.2%
2006	7.41	2.37	5.03	68.0%	1.47	5.93	80.1%
2007	8.06	2.50	5.56	68.9%	1.48	6.59	81.7%
2008	8.86	2.64	6.21	70.2%	1.48	7.38	83.3%
2009	9.44	2.79	6.65	70.5%	1.48	7.96	84.3%
2010	9.88	2.94	6.94	70.2%	1.48	8.40	85.0%
2011	10.01	3.11	6.90	69.0%	1.48	8.52	85.2%
2012	9.19	3.27	5.91	64.4%	1.48	7.70	83.9%
2013	8.30	3.46	4.84	58.4%	1.49	6.82	82.1%
2014	7.67	3.65	4.02	52.4%	1.49	6.18	80.6%
2015	7.17	3.86	3.31	46.2%	1.49	5.68	79.2%
2016	6.48	4.07	2.41	37.2%	1.49	4.99	77.0%
2017	5.52	4.30	1.22	22.0%	1.50	4.02	72.9%
2018 <sup>57</sup>		4.55			1.50		
<b>1998-2017</b>	<b>130.18</b>	<b>53.94</b>	<b>76.24</b>	<b>58.6%</b>	<b>29.52</b>	<b>100.66</b>	<b>77.3%</b>

159. Opioid dosage units dispensed in Ohio have declined 37% from 2012 to 2018. The percentage decline in dosage units dispensed in Ohio has increased each year suggesting that even the 2018 levels exceed the medically necessary level. My estimates of excessive opioid shipments into Ohio can be varied to reflect how much, if any, of the increase from 1997 to 2018 in per

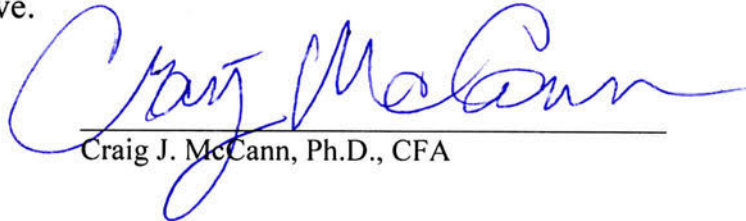
<sup>57</sup> Estimated from the 2017 level reported in the RDSRs and 2018 decline from 2017 reported in Ohio Automated Rx Reports System, 2018 Annual Report, State of Ohio Board of Pharmacy, Section 1, Chart 1 available at [www.ohiopmp.gov/documents/Annual%20Report%20\(2018\).pdf](http://www.ohiopmp.gov/documents/Annual%20Report%20(2018).pdf)

69.8% of the opioids dispensed from 1998 to 2017 and 76.3% of the opioids dispensed from 2006 to 2014 were excessive.

- If 20% of the increase in opioids dispensed in Ohio in 2018 compared to the 1997 per capita level were medically necessary, 73.6% of the opioids dispensed from 1998 to 2017 and 79.7% of the opioids dispensed from 2006 to 2014 were excessive.
- If none of the increase in opioids dispensed in Ohio in 2018 compared to the 1997 per capita level were medically necessary, 77.3% of the opioids dispensed from 1998 to 2017 and 83.1% of the opioids dispensed from 2006 to 2014 were excessive.

160. My estimates of the percentage excessive shipments into Ohio in Table 45 - which average 71.3% - are a useful frame of reference for evaluating the transactions flagged by the methods in the previous subsections. For example, the Maximum Monthly Trailing 6-Month Threshold flagged 76.0% of transactions, 89.6% of dosage units and 73.5% of MME shipped to pharmacies in Cuyahoga County and 75.4% of transactions, 88.5% of dosage units and 71.4% of MME shipped to pharmacies in Summit County. The purpose of identifying transactions – to determine which transactions warrant some further due diligence – is likely to only be met by flagging more transactions than those which are used to fill medically unnecessary prescriptions. Thus, the decline in opioid use in Ohio and the implication that more than 70% of opioids shipped into Ohio were excessive, supports my identification of transactions.

183. The ARCOS Data can be used to identify transactions into a state, county, zipcode or individual pharmacy meeting certain criteria as I have illustrated above.



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